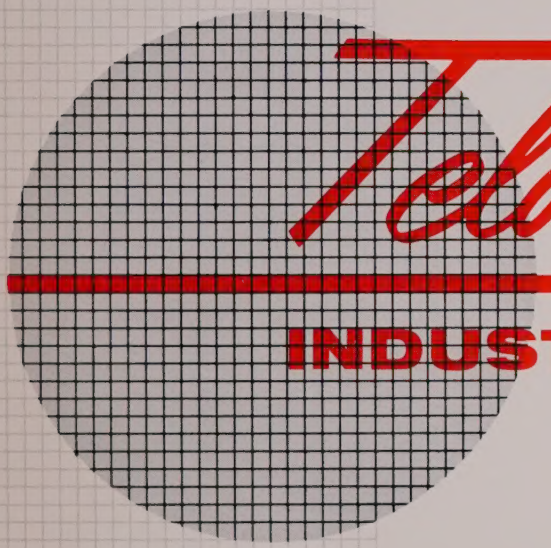
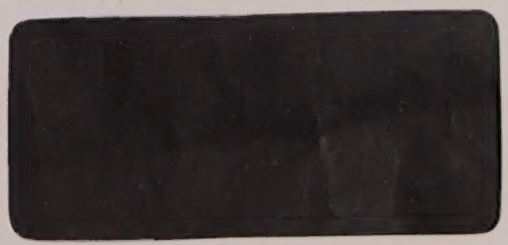
INSTRUCTION MANUAL





MODEL SX-350

SERIAL NO. 2789

SWEEP GENERATOR

Telonic INDUSTRIES, INC. BEECH GROVE, INDIANA

WARRANTY

TELONIC INSTRUMENTS AND ACCESSORIES

Products manufactured by TELONIC INDUSTRIES, INC. are guaranteed against defective materials and workmanship for a period of one year (vacuum tubes and semiconductors excepted) from date of purchase. This warranty does not apply to instruments that have been altered, improperly handled or damaged in any way beyond our control.

Instruments must be examined immediately upon receipt, since claims for damage in transit will not be honored by the carrier unless prompt action is taken.

CHANGES IN SPECIFICATIONS

The right is reserved to change the published specifications of equipment at any time, and to furnish merchandise in accordance with current specifications, without incurring any liability to modify equipment previously sold.

RETURNING EQUIPMENT TO FACTORY

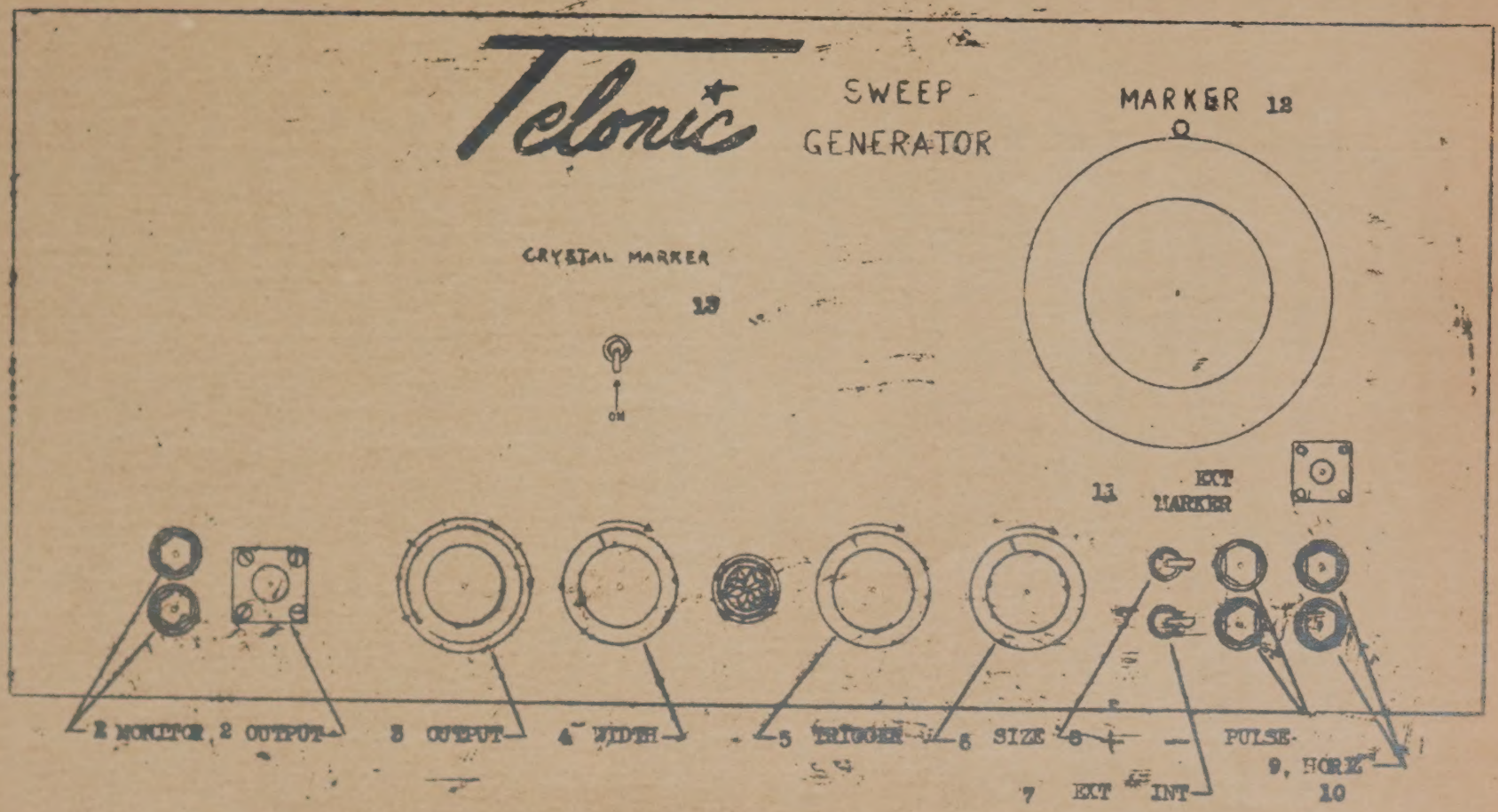
Factory service is available for repair and readjustment of this instrument. However, a description of the trouble should be forwarded FIRST, whereupon instructions for correcting the trouble OR authorization for returning the equipment will be given. This applies to all units, whether under warranty or not.

SPECIFICATIONS

MODEL SM-350
SWEEP GENERATOR

FREQUENCY RANGE	900-1250 mc. at fund. freq.---fixed-tuned
SWEEP WIDTH	350 mc.
OUTPUT VOLTAGE	1 volt
OUTPUT IMPEDANCE	50 ohms (Type N Connector)
DISPLAY LINEARITY	1.3:1 or better
FLATNESS	Less than 10% across the band
ATTENUATION	External coaxial pads recommended
VERNIER ATTENUATION	0-20 db.
LEAKAGE	Max. attenuation to approx. 10 microvolts
MARKER FREQ. RANGE	900-1250 mc.---calibrated every 10 mc.
MARKER ACCURACY	Plus/minus .8%
SCOPE HORIZONTAL SWEEP VOLTAGE	
ZERO BASE LINE	
POWER	110-130 v., 60 cps, 50 watts fused protected -- 2 amps
TUBE COMPLEMENT	3 -- 6AU6 2 -- 6AM4A 1 -- [illegible] 1 -- [illegible] 1 -- [illegible] 1 -- 6CB6 3 -- 12AX7 2 -- 12AU7 3 -- 6AL5
PHYSICAL DESCRIPTION	23" X 16" X 17" gray enameled case 8 3/4" X 19" gray anodized front panel (May be rack-mounted) Approx. weight -- 50#

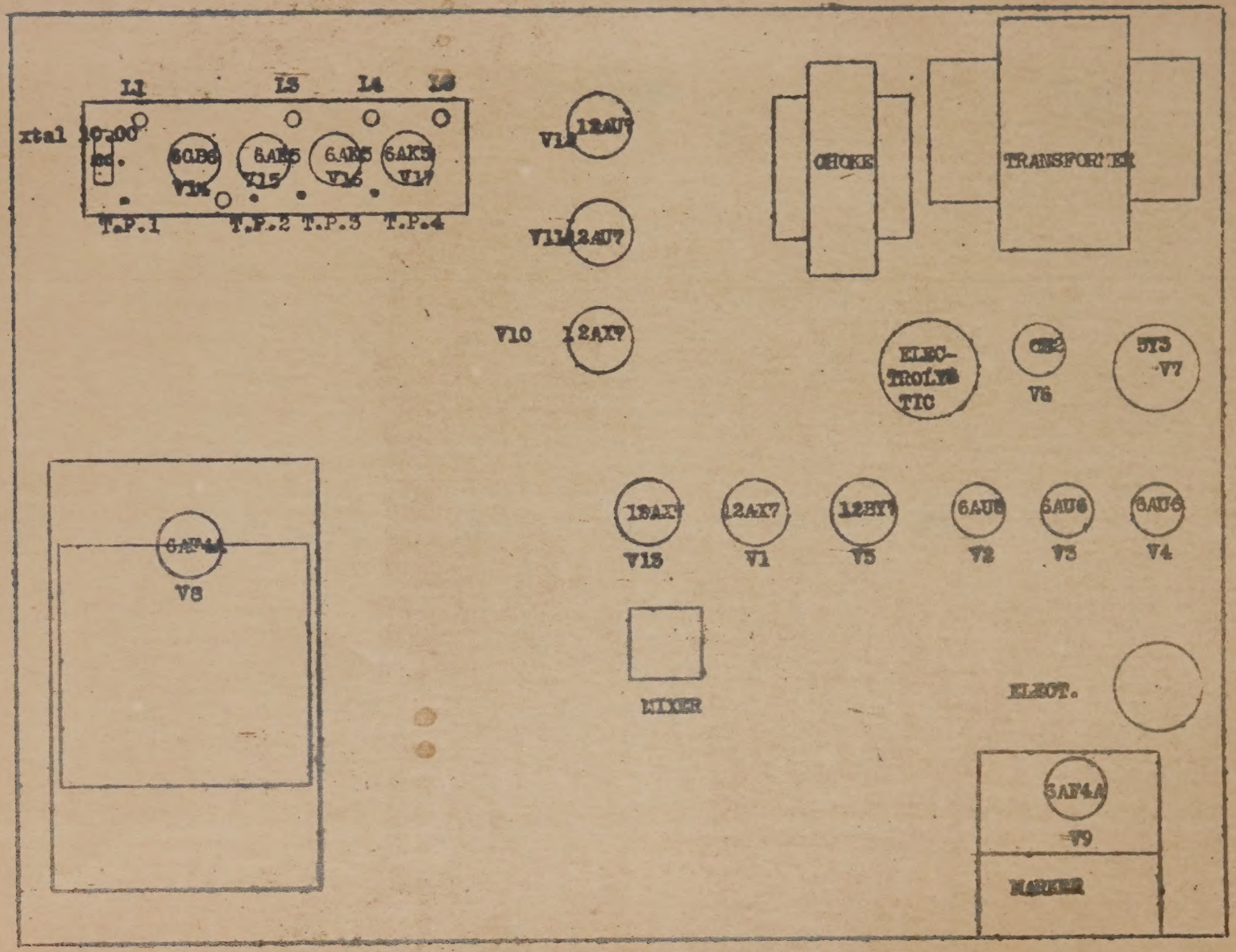
FRONT PANEL — MODEL SW-500



FUNCTION OF FRONT PANEL CONTROLS

1	MONITOR	The monitor output may be connected to the vertical input of the scope to show the output response curve.
2	"N" CONNECTOR	A Type N Connector is used to obtain the best impedance match and to be compatible with coaxial attenuator pads. An adopter may be used to convert to the more convenient BNC type connector.
3	OUTPUT	This potentiometer determines the average B plus supplied to the sweep oscillator and may be used as a vernier control of the output level.
4	SWEEP WIDTH CONTROL & POWER OFF SWITCH	This control is used to adjust the deviation of the vibrating capacitor. Since the center frequency is not adjustable, the sweep width control will normally be set for maximum sweep. It is possible to overdrive the sweep capacitor but due to the type of construction, this is not likely to cause damage.
5	TRIGGER	The trigger is adjusted by turning the control in a clockwise direction as far as possible before the pulse multivibrator becomes free-running.
6	SIZE	This control allows adjustment of pulse output from 0-50 v.
7	INT/EXT	The marker may either be used internally to modulate the output signal or be brought out the front panel for connection to a scope.
8	PLUS/MINUS	The pulse marker may be in either the positive or negative direction
9	PULSE	Pulse marker output
10	HORIZ. OUTPUT	These terminals are connected to the scope horiz. amplifier input. Using the waveform at these terminals will produce a more linear and more stable presentation than by using the internal horiz. drive of the scope.
11	EXT MARKER	For insertion of CW signal to key pulse marker. Signal in the order of .1 v. is adequate.
12	MARKER	The marker frequency is controlled by the knob on the upper right hand portion of the panel. The dial is calibrated at 10 mc. intervals.
13	CRYSTAL MARKER	Connects B+ to crystal oscillator in UP position and to the variable marker in DOWN position.

CHASSIS LAYOUT — WIDE SWEEP GENERATOR — MODEL SK-500

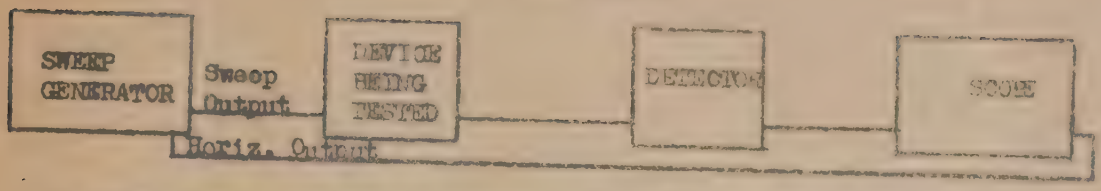


FUNCTION OF REAR PANEL CONTROLS

BLANKING WIDTH	This potentiometer is the grid resistor of the blanking pulse amplifier (V8). It is adjusted to blank slightly more than one-half of the sweep cycle to produce a zero base line.
BLANKING PHASE	By this screw-driver adjustment, the phase of the blanking voltage may be adjusted to blank the return sweep of the sweep oscillator.
HORIZONTAL PHASE	By this screw-driver adjustment, the horizontal output may be adjusted to be in phase with the sweep oscillator.
AMPLITUDE MINIMUM LIMIT	This control is in series with the front panel control and is used to adjust the output level when the front panel control is at minimum position
AMPLITUDE MAXIMUM LIMIT	This control is in parallel with the front panel control and is used to adjust the output level when the front panel control is at maximum position
SWEEP WIDTH LIMIT	The potentiometer controls the voltage supplied to the Front Panel Sweep Width control and is used to adjust the sweep width when the Front Panel control is set at maximum.
LINEARITY	This control can be used to change the wave-form of the horizontal output. It is normally set for best linearity at the maximum sweep width. For narrow sweep widths, a sinusoidal wave-form, such as is often available on the scope produces a more linear presentation.

OPERATING INSTRUCTIONS

TYPICAL SET-UP



The following procedure is recommended for using this instrument:

1. Connect unit to 110-120 volt, 50 or 60 cycle supply. Although this instrument may be used immediately after tube warm-up, the marker requires 5-10 minutes to reach specified calibration accuracy.

2. Connect HORIZONTAL terminals to scope horizontal amplifier input. The horizontal output voltage is over 15 volts peak to peak and should produce a full horizontal deflection on any oscilloscope.

3. Connect output to a detector as shown above, but omitting test device.

4. Set EXT/INT switch (marker) to INT.

5. Rotate SIZE control clockwise.

6. Rotate TRIGGER control clockwise as far as possible without allowing the pulse marker multivibrator to become free-running.

7. Turn XTAL Marker switch to OFF position.

8. Adjust MARKER until pulse marker appears on waveform.

Rear panel controls are adjusted at the factory and the instrument is ready to use. However, should it be desirable to check these adjustments, follow these steps:

9. Adjust the BLANKING PHASE control to cause the sweep oscillator to be blanked during the return half of its sweep. This may be accomplished as follows:

   a. With an output detector connected to the scope vertical input and the HORIZONTAL terminals connected to the scope horizontal input--tune the MARKER until the marker pip appears on the scope trace.

   b. Tune the marker pip across the response curve until a point is located where a second pip converges with the first. This indicates the point at which the sweep oscillator reaches the end of its sweep and reverses direction.

   c. The BLANKING PHASE is adjusted to [illegible]

10. Adjust BLANKING WIDTH until the sweep oscillator is only operating during one-half of the sweep cycle.

11. Adjust the HORIZONTAL PHASE control so that the horizontal output corresponds to the phase of the sweep oscillator. Since the blanking is already adjusted to the end of the sweep, it is only necessary to adjust the HORIZONTAL PHASE to place the lowest frequency on one side of the scope and the highest frequency at the other. When the HORIZONTAL and BLANKING PHASE & WIDTH controls are properly adjusted, the monitor waveform will have a rectangular shape.

12. Set the AMPLITUDE control (front panel) for about one-half of maximum output for normal operation. For low level applications, leakage can be minimized by keeping the AMPLITUDE control set for low output.

13. For crystal-controlled markers, place the XTAL switch to the ON position. Harmonics of a 10 mc. crystal are amplified and used to produce markers that are 10 mc. apart across the band (900, 970, 980 mc etc.) The variable marker can be used to identify these crystal markers by switching back and forth and noting the point on the response curve where the markers fall.

14. For externally applied markers, switch INT/EXT to EXT. position. The pulse output may be used in several ways:

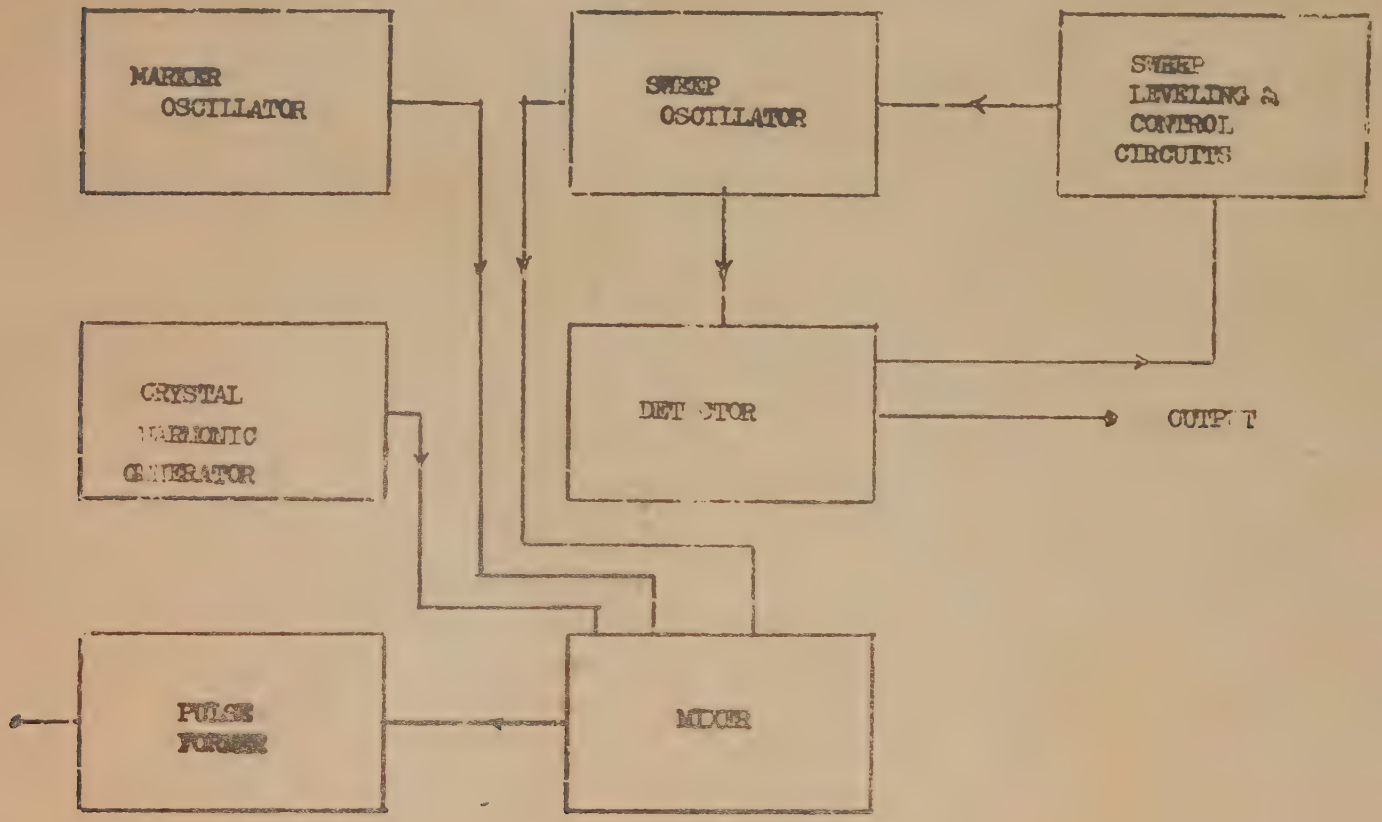
a. Connected to the vertical deflection plates through .01 capacitor for sharp markers unaffected by vertical input amplifier of the scope or device under test.

b. Connected to Z input for intensity or blanked markers.

c. Connected to horizontal deflection plates for placing marks on side of a steep curve.

BLOCK DIAGRAM

SWEEP GENERATOR WITH PULSE-TYPE CALIBRATED MARKER AND CRYSTAL-CONTROLLED MARKERS



GENERAL DESCRIPTION

BLANKING AND HORIZONTAL CIRCUITRY

The blanking and horizontal sweep voltages are obtained by square wave generating circuits. The 6.3 v. filament transformer and the 6.3 v. winding of the power transformer are connected in series to obtain a 12.6 voltage center-tapped to ground. This voltage is connected through the phasing network to one of the grids of the 12AT7 and to the grid of the 6AU6.

The square wave output of the 6AU6 controls the 12AT7 sweep oscillator voltage regulator tube and thus regulates the timed oscillator of voltage during one-half of each cycle. The speed of this blanking voltage is adjusted by the front panel control so that the lowest frequency being swept is located at the left of the scope presentation. The square wave output of one triode of the 12AT7 is applied to the other triode through an RC network. This network is designed to produce a non-linear sawtooth waveform. A potentiometer in this circuit allows the shape of the waveform to be adjusted.

The second triode is connected as a cathode follower and produces the same sawtooth output. This horizontal sweep voltage compensates for the non-linear characteristics of the variable sweep oscillator and results in an almost perfectly linear presentation on the oscilloscope.

AUTOMATIC OUTPUT LEVELING CIRCUITRY

A sample of the tuned oscillator output is detected and amplified and is used to control the plate voltage of the tuned oscillator. The OUTPUT LEVEL control adjusts the bias on the first stage of the amplifier. This causes the DC levels in the entire amplifier to change and varies the average B plus supplied to the tuned oscillator from a minimum of 25 volts to over 100 volts. A small increase in the sampling voltage causes a large increase in the B plus supplied by the sweep oscillator and thus counteracts any amplitude variation as the oscillator is tuned over the range.

The operation of this circuit may be observed at the detector capacitor at the end of the filter line. The voltage at this point will normally show a flat output level over the entire band. Adjusting the OUTPUT LEVEL should change this level. This control should be set at the maximum level that can be obtained and still have uniform response over the range.

MAINTENANCE

This instrument is designed for easy maintenance. All tubes and components are of standard types and are easy to remove and replace. There are only a few points that need to be mentioned.

MONITOR FOR CHECKING PERFORMANCE

The detector output serves as a very convenient check of the sweep generator performance. With the OUTPUT LEVEL control set for maximum output, the voltage at this point should be over 1.0 volt. A lower voltage than this indicates poor operation of the crystal diode, sweep oscillator or amplitude leveling circuit.

FAULTY OUTPUT SAMPLING DIODE

If the sweep output is higher than normal and the OUTPUT LEVEL control has little or no effect, then the diode is probably faulty; the diode or insulated plate is shorting to ground; or the crystal is making poor contact.

SWEEP OSCILLATOR TUBE

If the leveling circuit is working, but the output drops off at certain frequencies, the 6AF4A should be replaced.

Sometimes poor operation of the sweep oscillator tube appears as a tendency of the leveling circuit to oscillate at an audio frequency. This effect occurs when the B plus voltage level is too low for the sweep oscillator to operate but when the amplifier is not biased down to the point where it will allow the sweep oscillator to stop. It is more likely to take place at the extreme high end of the band at low operating levels. Usually the amount of attenuation possible through use of the OUTPUT LEVEL control, before this oscillation takes place, is a direct indication of the quality of the sweep oscillator tube (6AF4A).

When this tube is replaced, the best results can be obtained by trying several tubes and then choosing the one that produces the most constant output. The RCA 6AF4A or Sonotone 6AF4A operates better in this circuit than other brands.

MARKER CALIBRATION

Every effort has been made to insure the accuracy of the marker calibration. By using a crystal standard of .005% accuracy and by very careful engraving and mounting, an accuracy of better than $\pm$ - .25% is obtained. Each oscillator is checked for grid emission and only the best performing tubes are used. Changing this tube would naturally cause an error in the calibration. By trying several tubes and by rotating the dial on the shaft, this error can usually be held to a small amount. For greater accuracy, a factory recalibration is recommended.

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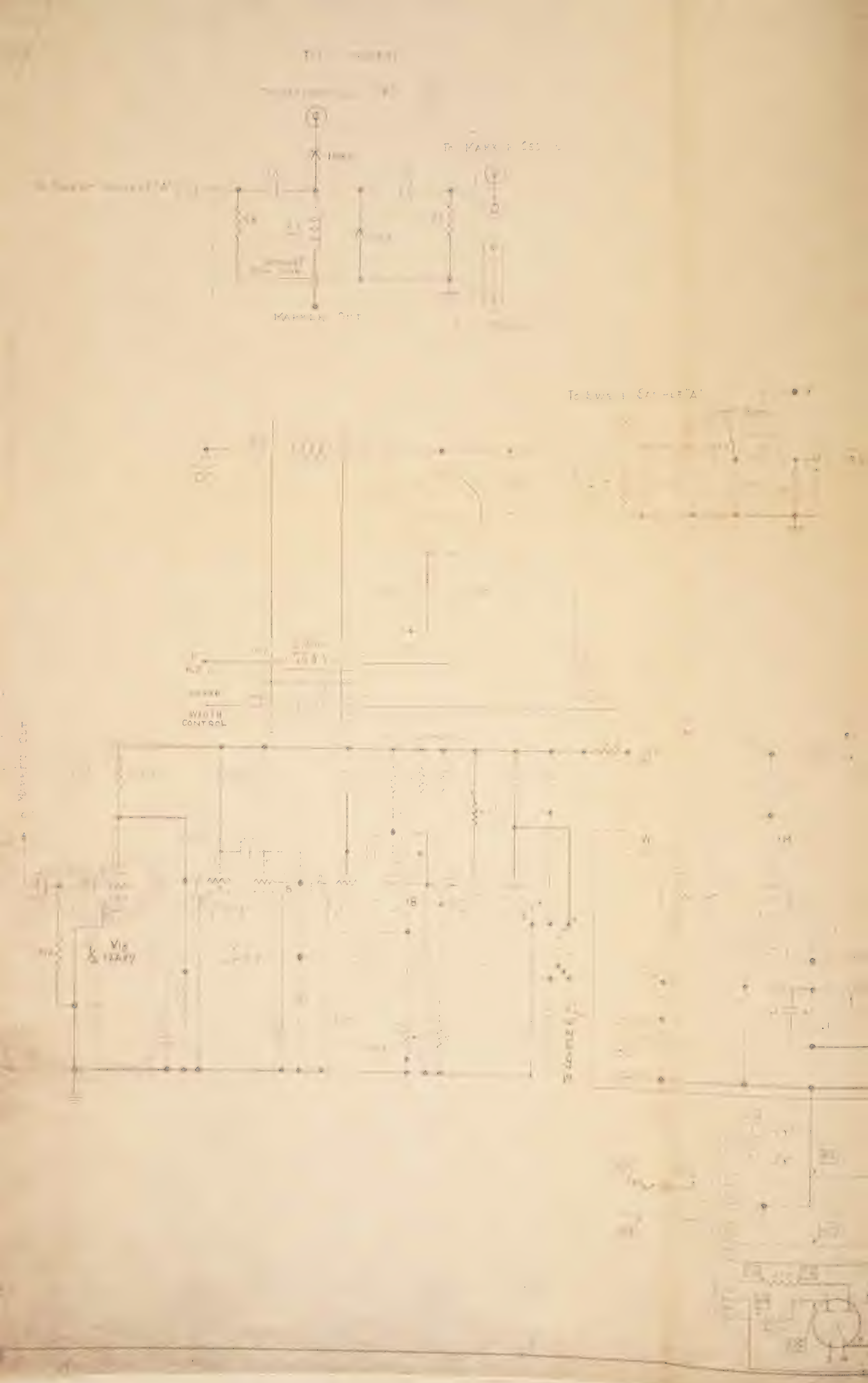
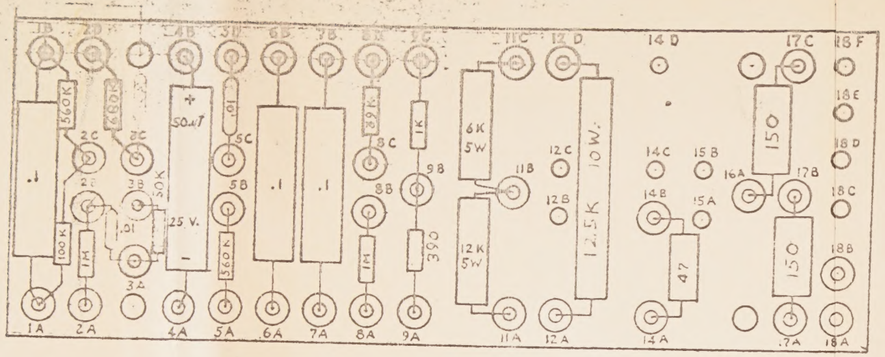
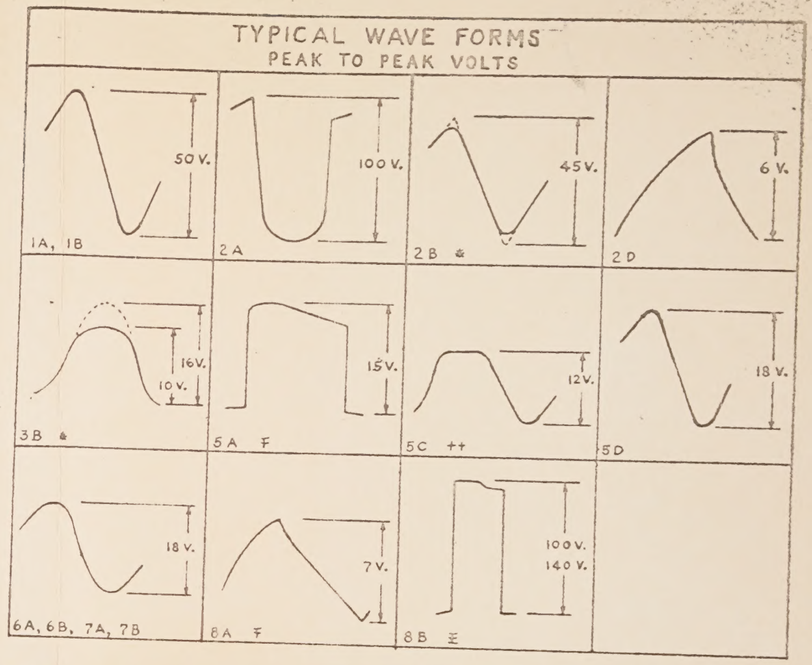

MARKER OUT
WIDTH
CONTROL

MIN. LIMIT
TO DETECTOR
SWEEP MOTOR
"Y Y"
ALL CAPACITORS μμ UNLESS OTHERWISE SPECIFIED.
ALL RESISTOR VALUES: Ω - OHMS, K - 1000 OHMS
M - 1,000,000 OHMS, ½ WATT UNLESS OTHERWISE SPECIFIED.
F.P. FRONT PANEL
R.P. REAR PANEL (CHASSIS)
T.P. - TEST POINT
TELONIC INDUSTRIES, INC.
SX-500
WIDE BAND SWEEP GENERATOR
SCHEMATIC
SCALE
DRAWN BY
DATE
APPROVED BY
DATE
SHEET 1



TYPICAL WAVE FORMS
PEAK TO PEAK VOLTS



FRONT CONTROLS AT MAX. C.W. ROTATION SCOPE SET FOR 60~ SWEEP RATE, LINE SYNC.

* SHAPE VARIES WITH SWEEP WIDTH CONTROL.
∓ VARIES AMPLITUDE WITH OUTPUT LEVEL CONTROL.
++ VARIES AMPLITUDE WITH BLANKING WIDTH CONTROL.
± VARIES AMPLITUDE WITH OUTPUT LEVEL CONTROL AND FREQUENCY SETTING.

VOLTAGE CHART

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
A	180	87			4.0			350	2.7 *		360	360		-2.2		340 AC	340 AC	LINE
B		152		3.0 *	19	-2.6		80 *			30						340 AC	LINE
C			283		-6.0			58 *	20		19						340 AC	
D		358						80 *				105						
E																		
F																		

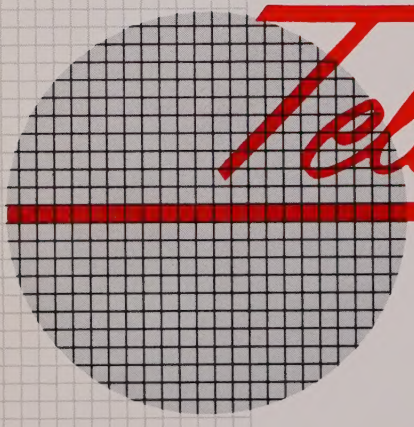
ALL VOLTAGES TAKEN WITH 20,000 OHM/VOLT METER.
OUTPUT LEVEL AND SWEEP WIDTH CONTROLS AT MAXIMUM ROTATION.
VOLTAGE VARIES WITH SETTING OF OUTPUT LEVEL CONTROL.
ALL VOLTAGES MAY VARY ±10%.

REVISIONS	
NO.	DATE

Telonic INDUSTRIES
73 N. 2 ND. AVE.
BEECH GROVE
INDIANA

SX-350 TERMINAL BOARD
VOLTAGE LEVELER & POWER SUPPLY

SCALE		SHEETS	DRAWING. NO.
DRAWN BY W. R. Peters	DATE 11-18, 1956	SHEET	06-3160
APP'VD BY	DATE		



Telonic INDUSTRIES INC.

BEECH GROVE, INDIANA